

SECTION 13916 – FIRE SPRINKLER SYSTEMS (15 April 2005)

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes fire-suppression piping inside the building.
- B. Furnish all materials, equipment and supplies and perform all work and operations to design, construct and make functional a fire sprinkler system as shown on the drawings and specified herein.

1.2 REGULATIONS

- A. The design of fire suppression systems at Hill AFB shall be governed by UFC 3-600-01. This is a DOD regulation, and it should be noted that in some situations it is more restrictive than NFPA 13, including remote area determination and hose allowance involved with hydraulic calculations as well as area coverage per sprinkler. UFC 3-600-01 is available in electronic format on the internet; contact the project manager for the internet address.
- B. Comply with the latest edition of NFPA 13 except for those issues that are superseded by UFC 3-600-01.

1.3 PERFORMANCE REQUIREMENTS

- A. System Design Criteria: Determination of the following items shall not be the responsibility of the contractor:
 - 1. Water service line that will be connected into to serve the fire sprinkler system riser.
 - 2. Type of sprinkler system (i.e. wet, dry, pre-action, etc.)
 - 3. Temperature rating of the sprinkler heads.
 - 4. Backflow prevention assembly requirements (double check, reduced pressure).
 - 5. Occupancy hazard classification (light, ordinary, extra).

If the above information has not been provided or adequately clarified on the contract drawings or elsewhere in the contract, the contractor shall notify the Project Manager who will contact the Hill AFB Fire Protection Engineer in coordination with the Hill AFB Fire Department to determine this information.

- B. Hydraulic Calculations and Shop Drawings: The contractor shall provide shop drawings and hydraulic calculations on the layout of each fire sprinkler system indicated in the contract. If the contract drawings have sprinkler head layout and piping sizing already shown, they are for intent only. The requirements of this contract call for specific shop drawings and hydraulic calculations. Shop drawings and associated hydraulic calculations shall both be stamped (to include certification number) and signed by a NICET Level III certified person or a Professional Engineer that is registered as a Fire Protection Engineer. Once the shop drawings and hydraulic calculations have been approved, any deviation from these drawings during the process of installation must be submitted for approval by the Hill AFB Fire Protection Engineer and Hill

AFB Fire Department. A copy of the approved shop drawings shall be available at the job site at all times during the project.

1. Shop Drawings: These drawings shall be 22" x 34" in size. The sprinkler system shop drawings shall conform to the requirements established for working plans as prescribed in NFPA 13, under the chapter titled "Plans and Calculations". Each set of drawings shall include as a minimum the following:
 - a. Descriptive index of drawings with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.
 - b. Title block that includes the project name, project location (Bldg. number), name, address and phone number of contractor, scale, date and name of the person who designed the layout.
 - c. Sprinkler schedule with symbol, make, model, type, finish, orifice size, K-factor, temperature rating and quantity.
 - d. Applicable notes, including flow data used in hydraulic calculations, occupancy classification of each area or room, etc.
 - e. Floor plans drawn to a scale not less than $1/8" = 1'-0"$ which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated. North orientation shall be indicated. Provide graphical representation of scale. Drawings shall show hydraulic reference points and pipe segment identification. Remote area used for hydraulic calculations shall be clearly indicated on the plan.
 - f. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.
 - g. Longitudinal building section showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor. Drawings shall include plan and elevations views demonstrating that the equipment will fit the allotted spaces with clearances for installation and maintenance.
 - h. Show seismic restraint locations and include Seismic Bracing Calculations on the drawing if sufficient space exists, otherwise provide these calculations on a separate 8.5" x 11" sheet(s) of paper.
 - i. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices (flow switch, tamper switch, etc.) and interconnecting wiring.

- j. Plot plan to reference the water source back to the point where the hydrant flow data was obtained.
2. Hydraulic Calculations: Calculations shall verify that sufficient flow and pressure are available to serve the fire suppression system being designed. This shall include a 10% margin of safety as a minimum. Water velocity in the piping shall be designed to not exceed 20 feet per second. Calculations shall be based on friction losses all the way back to the point of connection where the hydrant flow test data is considered valid. Calculations shall substantiate that the design area used in the calculations is the most demanding hydraulically. Each set of hydraulic calculations shall include as a minimum the following:
- a. Design area information
 - b. Provide a graph showing the available supply curve and the calculated system demand point.
 - c. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated.
 - d. Indicate the exact model, manufacturer, size, etc. of the backflow device and provide catalog cut of flow vs. pressure loss chart for that specific model being used in the calculations.
 - e. The diameter, length, flow, velocity, friction loss, number and type of fittings, total friction loss in the pipe, equivalent pipe length and Hazen Williams coefficient shall be indicated for each pipe.
 - f. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems a flow diagram indicating the quantity and direction of flows shall be included.
 - g. Documentation shall identify each pipe individually and the nodes connected thereto. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.
- C. Hydrant Flow Test
- 1. The contractor shall be required to conduct a hydrant flow test to determine the data to be used for hydraulic calculations. Data to acquire from the flow test is static pressure, residual pressure, and volume of flow in gallons per minute. Prior to doing a hydrant flow test, contact the Hill AFB Fire Department to determine if recent flow data exists. If flow data is less than one year old, then depending on site conditions, etc., a new flow test may not be required. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Indicate date and time of the flow test and include location of test (hydrant numbers and approximate street locations). A fire protection engineer or an engineer experienced in water flow testing shall perform or witness the test and verify that the results are accurate. Provide on the report, the name and credentials of the person(s) who conducted the test.
 - 2. If the suppression system being designed is served from the high pressure fire protection piping loop, then the flow test is more complicated in that there are few hydrants, and the system is served by diesel driven fire pumps. Coordinate with the project manager and

the Hill AFB Fire Department to determine and coordinate the process of doing a flow test.

- D. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13, and based on the seismic zone for Hill AFB.

1.4 SUBMITTALS

- A. Product Data: For the following:

1. Piping materials, including dielectric fittings, flexible connections, and sprinkler specialty fittings.
2. Pipe hangers and supports, including seismic restraints.
3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
4. Backflow preventer.
5. Air compressors, including electrical data (dry type systems).
6. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
7. Fire department connections, including type, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
8. Electrical alarm bell.
9. Flow switch and tamper switch.

- B. Approved Sprinkler Piping Shop Drawings: Working plans, including hydraulic calculations. These must be submitted and approved before any fabrication or installation takes place; contractor takes the risk of having to remove any work that was not approved. Provide one copy; these shall be retained for Government reference.

- C. As-Built Shop Drawings: After the sprinkler system has been installed and completion of all final tests on the sprinkler system have taken place, as-built shop drawings shall be submitted that reflect any differences from the initial shop drawings.

- D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping". Also submit hydrant flow test report and backflow preventer test report.

- E. Operation and Maintenance Manuals: Provide operation and maintenance data for all components of the fire sprinkler system. Provide three copies of the O and M manual.

1.5 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Sprinkler heads shall be compatible architecturally with the surrounding space. Refer to the architectural drawings of this contract for any specific requirements in this regard.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench; include separate wrench for each type of sprinkler.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Unless otherwise specified, all fire sprinkler components shall be UL listed and Factory Mutual (FM) approved.

2.2 STEEL PIPE AND FITTINGS

- A. All piping shall be schedule 40 steel pipe. Some pipe manufacturers offer a pipe that they claim is a substitute replacement for Schedule 40 steel pipe, yet the wall thickness is thinner than standard schedule 40 steel pipe; no substitutes will be allowed. The pipe wall thickness must meet the requirements of schedule 40 nominal pipe sizing.
- B. Threaded-End Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory-or field-formed threaded ends.
 - 1. Cast-Iron Threaded Flanges: ASME B16.1.
 - 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 - 3. Gray-Iron Threaded Fittings: ASME B16.4.
 - 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
 - 5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.
- C. Plain-End Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe where indicated.
 - 1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 - 2. Steel Flanges and Flanged Fittings: ASME B16.5.
- D. Grooved-End Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed, square-cut- or roll-grooved ends.
 - 1. Grooved-Joint Piping Systems:
 - a. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.

- b. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

2.3 DIELECTRIC FITTINGS

- A. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.
- B. Dielectric Unions: Factory-fabricated assembly, designed for 250-psig minimum working pressure at 180 deg F. Include insulating material that isolates dissimilar materials and ends with inside threads according to ASME B1.20.1.
- C. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 175-psig minimum working-pressure rating as required for piping system.
- D. Dielectric Flange Insulation Kits: Components for field assembly shall include CR or phenolic gasket, PE or phenolic bolt sleeves, phenolic washers, and steel backing washers.
- E. Dielectric Couplings: Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 300-psig working-pressure rating at 225 deg F.

2.4 FLEXIBLE CONNECTORS

- A. Flexible connectors shall have materials suitable for system fluid. Include 175-psig minimum working-pressure rating and ends according to the following:
 - 1. NPS 1.5 and Smaller: Threaded.
 - 2. NPS 2 and Larger: Flanged.
 - 3. Option for NPs 2 and Larger: Grooved for use with grooved-end-pipe couplings.
- B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.
- C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.
- D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.5 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping.
- B. Outlet Specialty Fittings:

1. Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and threaded, locking-lug, or grooved outlets.
 2. Snap-On and Strapless Outlet Fittings: UL 213, ductile-iron housing or casting with gasket and threaded outlet.
- C. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
- D. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
- E. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
- F. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
- G. Dry-Pipe-System Fittings: UL listed for dry-pipe service.

2.6 LISTED FIRE-PROTECTION VALVES

- A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating.
- B. Ball Valves: Comply with UL 1091, except with ball instead of disc.
1. NPS 1-1/2 and Smaller: Bronze body with threaded ends.
 2. NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
 3. NPS 3: Ductile-iron body with grooved ends.
- C. Butterfly Valves: UL 1091.
1. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.
- D. Check Valves NPS 2 (DN 50) and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.
- E. Gate Valves: UL 262, OS&Y type.
1. NPS 2 and Smaller: Bronze body with threaded ends.
 2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.
- F. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.
1. Indicator: Electrical, 115-V ac, prewired, 2-circuit, supervisory switch.
 2. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

2.7 UNLISTED GENERAL-DUTY VALVES

- A. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.
- B. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.
- C. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.8 SPECIALTY VALVES

- A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating.
 - 1. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
 - a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
 - 2. Dry-Pipe Valves: UL 260, differential type; with bronze seat with O-ring seals, single-hinge pin, and latch design. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - a. Air Compressor: UL 753, fractional horsepower, 120-V ac, 60 Hz, single phase.
 - 3. Deluge Valves: UL 260, cast-iron body, hydraulically operated, differential-pressure type. Include bronze seat with O-ring seals, trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, fill-line attachment with strainer, and push-rod chamber supply connection.
 - a. Wet, Pilot-Line Trim Set: Include gage to read push-rod chamber pressure, globe valve for manual operation of deluge valve, and connection for actuation device.
 - b. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gages; low-air-pressure warning switch; air relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.

2.9 SPRINKLERS

- A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Sprinklers shall have 250-psig pressure rating if sprinklers are components of high-pressure piping system.
- B. Automatic Sprinklers: With heat-responsive element complying with the following:
 - 1. UL 199, for nonresidential applications.
 - 2. UL 1767, for early-suppression, fast-response applications.
- C. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
 - 1. Open Sprinklers: UL 199, without heat-responsive element.
 - a. Orifice: 1/2 inch , with discharge coefficient K between 5.3 and 5.8.
 - b. Orifice: 17/32 inch, with discharge coefficient K between 7.4 and 8.2.
- D. Sprinkler types, features, and options as follows:
 - 1. Concealed ceiling sprinklers, including cover plate.
 - 2. Extended-coverage sprinklers.
 - 3. Flush ceiling sprinklers, including escutcheon.
 - 4. High-pressure sprinklers.
 - 5. Institution sprinklers, made with a small, breakaway projection.
 - 6. Open sprinklers.
 - 7. Pendent sprinklers.
 - 8. Pendent, dry-type sprinklers.
 - 9. Quick-response sprinklers.
 - 10. Recessed sprinklers, including escutcheon.
 - 11. Sidewall sprinklers.
 - 12. Sidewall, dry-type sprinklers.
 - 13. Upright sprinklers.
- E. Sprinkler Finishes: Chrome plated, bronze, and painted, unless otherwise specified in the architectural drawings and specifications of this project.
- F. Special Coatings: Wax, lead, and corrosion-resistant paint.
- G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - 1. Ceiling Mounting: Chrome-plated steel, one piece, flat with 1-inch vertical adjustment.
 - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- H. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.10 FIRE DEPARTMENT CONNECTIONS

- A. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR & STANDPIPE."
1. Type: Exposed, projecting, with two inlets and round escutcheon plate.
 2. Finish: Rough chrome-plated.

2.11 BACKFLOW PREVENTER

- A. Double Check Valve Assembly: The main valve body shall be manufactured from 300 series stainless steel to provide corrosion resistance. The double check shall consist of two independently operated spring loaded cam-check valves, required test cocks, and inlet and outlet resilient seated shutoff valves. Each cam-check shall be internally loaded and provide a positive drip tight closure against the reverse flow of liquid caused by backsiphonage or backpressure. The modular cam-check includes a stainless steel spring and cam-arm, rubber faced disc and a replaceable seat. There shall be no brass or bronze parts used within the cam-check valve assembly. The valve cover shall be held in place through the use of a single grooved style two-bolt coupling. The main assembly shall consist of two independently operating torsion spring check assemblies, two resilient seated isolation valves, and four ball valve type test cocks. The assembly shall be on the Utah Department of Environmental Quality list of approved backflow prevention assemblies/devices. The assembly shall be an Ames Series 2000SS or Government approved equal.
- B. Reduced Pressure Zone Assembly: The main valve body shall be manufactured from 300 series stainless steel to provide corrosion resistance. The assembly shall consist of a pressure differential relief valve located in a zone between two positive seating cam-check assemblies. The cam-check assembly shall be of thermoplastic construction with stainless steel hinge pins, cam arm, and cam bearing. The cam-check assembly shall utilize a single torsion spring design to minimize pressure drop through the assembly. The cam-check assembly shall be modular and shall seal to the main valve body by the use of an O-ring. There shall be no brass or bronze parts used within the check assembly or relief valve. The use of seat screws to retain the check valve seat is prohibited. All internal parts shall be accessible through a single cover on the valve assembly securely held in place by a two-bolt grooved coupling. The differential relief valve shall be of stainless steel construction and shall utilize a rolling diaphragm and no sliding seals. The relief valve shall be bottom mounted and supplied with a steel reinforced sensing hose. The assembly shall include two resilient seated shutoff valves and four ball type test cocks. The assembly shall be on the Utah Department of Environmental Quality list of approved backflow prevention assemblies/devices. The assembly shall be an Ames Series 4000SS or Government approved equal.

2.12 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.

- B. Electrically Operated Alarm: UL 464, with 10-inch diameter, vibrating-type, metal alarm bell with red-enamel factory finish and suitable for outdoor use.
- C. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
- D. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
- E. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

2.13 PRESSURE GAGES

- A. Description: UL 393, 3-1/2- to 4-1/2-inch diameter, dial pressure gage with range of 0 to 250 psig .
 - 1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
 - 2. Air System Piping: Include caption "AIR" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS, GENERAL

- A. Shop weld pipe joints where welded piping is indicated. No field welding will be allowed.
- B. Do not use welded joints for galvanized-steel pipe.
- C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- D. Piping between Fire Department Connections and Check Valves: Galvanized, schedule 40 steel pipe with grooved joints.

3.2 SPRINKLER SYSTEM PIPING APPLICATIONS

- A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig Maximum Working Pressure:
 - 1. NPS 1-1/2 and Smaller: Threaded-end, black, schedule 40 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
 - 2. NPS 2 and Larger: Grooved-end, black, schedule 40 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- B. Standard-Pressure, Dry-Pipe Sprinkler System, 175-psig Maximum Working Pressure:

1. NPS 1-1/2 and Smaller: Threaded-end, galvanized, schedule 40 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
2. NPS 2 and Larger: Grooved-end, galvanized, schedule 40 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.3 VALVE APPLICATIONS

A. Where specific valve types are not indicated, the following requirements apply:

1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13.
 - a. Shutoff Duty: Use ball, butterfly, or gate valves.
2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13.
 - a. Shutoff Duty: Use ball, butterfly, or gate valves.
 - b. Throttling Duty: Use ball or globe valves.

3.4 JOINT CONSTRUCTION

- A. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
1. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
 2. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.
- B. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.
1. NPS 2 and Smaller: Use dielectric unions, couplings, or nipples.
 2. NPS 2-1/2 to NPS 4: Use dielectric flanges.
 3. NPS 5 and Larger: Use dielectric flange insulation kits.

3.5 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Project Manager before deviating from approved working plans.
- B. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- C. Install unions adjacent to each valve in pipes NPS 1.5 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

- D. Install flanges or flange adapters or grooved joints on valves, apparatus, and equipment having NPS 2 and larger connections.
- E. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- F. Install sprinkler piping with drains for complete system drainage.
- G. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- H. Install alarm devices in piping systems. When drilling out pipe for a water flow switch, retrieve the drilled out disc and attach with wire to the flow switch U-bolt as evidence that it was not left inside the piping.
- I. Hangers and Supports: Comply with NFPA 13 for hanger materials.
 - 1. Install sprinkler system piping according to NFPA 13.
- J. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.
- K. Install pressure gages on riser or feed main, and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- L. Drain dry-pipe sprinkler piping.
- M. Pressurize and check dry-pipe sprinkler system piping.
- N. Fill wet-pipe sprinkler system piping with water.
- O. Run all piping in concealed spaces, unless otherwise specified. Where exposed pipe is allowed, it shall be painted to match the wall or ceiling it is suspended from.
- P. Core drill for all penetrations through concrete and masonry walls; seal all penetrations through fire rated walls.

3.6 VALVE INSTALLATION

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install backflow preventers instead of check valves in potable-water supply sources.
- D. Specialty Valves:

1. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.
2. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - a. Air-Pressure Maintenance Devices for Dry-Pipe Systems: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.
 - b. Install air compressor and compressed-air supply piping if none exists, otherwise connect into existing compressed air system that is dedicated to fire protection.
3. Deluge Valves: Install in vertical position, in proper direction of flow, in main supply to deluge system.

3.7 SPRINKLER APPLICATIONS

- A. Sprinklers shall be compatible architecturally with the surrounding space. Refer to the architectural drawings of this contract for any specific requirements in this regard.
- B. Where specific types are not indicated, use the following sprinkler types:
 1. Rooms without Ceilings: Upright sprinklers.
 2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers, as indicated.
 3. Wall Mounting: Sidewall sprinklers.
 4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
 5. Deluge-Sprinkler Systems: Upright and pendent, open sprinklers.
 6. Special Applications: Extended-coverage and flow-control sprinklers where indicated.
 7. Light Hazard and Ordinary Hazard: Use quick-response sprinklers.
 8. Sprinkler Finishes: Coordinate with the architectural sections of this project for specific requirements. If none exist, the following shall apply:
 - a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
 - b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 - c. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 - d. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

3.8 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles.
- B. Do not install wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

- C. Within the designated area to receive fire sprinklers, install adequate sprinklers to cover all spaces, including any combustible concealed spaces.

3.9 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire department connections in vertical wall.
- B. Install ball drip valve at each check valve for fire department connection. Drain to floor drain or outside building.

3.10 BACKFLOW PREVENTER INSTALLATION

- A. Install as per manufacturers recommendations.
- B. Reduced pressure type shall be installed if in contact with hazardous material such as glycol; otherwise double check type shall be used for all other applications.
- C. If installed in vertical position, then must be State of Utah Approved for such orientation.
- D. Unless otherwise specified, backflow preventers are required only on wet systems; pre-action, dry and deluge systems are exempt.
- E. Install valves and piping as needed to allow the backflow preventer to be forward flow tested (at sprinkler system demand flow) on a periodic basis.

3.11 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping.
- D. Connect piping to specialty valves, fire department connections, and accessories.
- E. Connect compressed-air supply to dry-pipe sprinkler piping.
- F. Connect air compressor to the following piping and wiring:
 - 1. Pressure gages and controls.
 - 2. Electrical power system.
 - 3. Fire alarm devices, including low-pressure alarm.
- G. Connect alarm devices to fire alarm.

3.12 CONVERSION FROM DRY TO WET SYSTEM

- A. When an existing dry type system is converted to a wet type system, any existing piping shall be flushed to remove corrosion debris. Flushing shall continue until water color no longer has corrosion elements observed. Flushing shall be observed by Project Manager or designated alternative. Coordinate a minimum of two days in advance to allow Project Manager time to schedule it in.
- B. Once a dry system has been converted to a wet system, any existing piping shall be pressure tested with air before being charged with water. Any existing piping that fails the air pressure test shall be brought to the attention of the Project Manager to determine a solution.

3.13 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.14 CLEANING AND PROTECTION

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.
- C. Protect sprinklers from damage.

3.15 TESTING

Notify the Hill AFB Fire Department, Project Manager and Hill AFB Fire Protection Engineer of all tests. Allow four days notice to allow adequate scheduling time for them to witness the tests.

- A. Flush, test, and inspect sprinkler system according to NFPA 13, "Systems Acceptance". Complete and submit the associated form "Contractor's Material and Test Certificate for Aboveground Piping"; submit to the Project Manager.
 - 1. Leak Test: After installation is complete, pressure test the system as per NFPA 13; repair any leaks and retest until no leaks exist.
 - a. Hydrostatic Test: Test all piping, including the section between the fire department connection and the check valve.
 - b. Pneumatic Test: For dry, pre-action and deluge systems, this test shall be required prior to doing a hydrostatic test.
 - 2. Operational Test: Open inspectors test station valve to check on flow switch.
 - 3. Tamper Switch: Test riser shut-off valves to see if tamper switches function properly.
 - 4. Perform the following:
 - a. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - b. Energize circuits to electrical equipment and devices.
 - c. Start and run air compressors (dry type systems).

- d. Coordinate with fire alarm tests. Operate as required.
 - e. Verify that equipment hose threads are same as local fire department equipment.
- B. Hydrant Flow Testing: Refer to "PERFORMANCE REQUIREMENTS" in PART 1 of this specification. Record the results on Air Force Form 1027 or on a report/graph as per NFPA 291. Contact the project manager for a blank copy of AF Form 1027. Testing shall be done using a 300 psi gage with 5 psi increments. All gages used in the flow testing shall be calibrated annually and shall be marked with the date of calibration.
- C. Backflow Preventer: Conduct all tests required by the State of Utah, including a forward flow test. Document results on the form "Backflow Prevention Assembly Test Report"; a blank copy of this report can be obtained from the Hill AFB Civil Engineering Utilities Shop.

3.16 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

END OF SECTION 13916